(12) UK Patent Application (19) GB (11) 2 072 573 A

(21) Application No 8038263
(22) Date of filing
28 Nov 1980
(30) Priority data
(31) 8010572
(32) 28 Mar 1980
(33) United Kingdom (GB)
(43) Application published
7 Oct 1981
(51) INT CL³ B66F 11/00
B23D 47/08
B24B 19/00 27/06
(52) Domestic classification
B5L 102 MA
B3D 1D3D 1H19 2A21
2HX
B8B R1
(56) Documents cited
GB 1389752
GB 1362059
GB 631480
GB 583687
GB 514300
GB 369354
(58) Field of search
B3D
B5L
B8B

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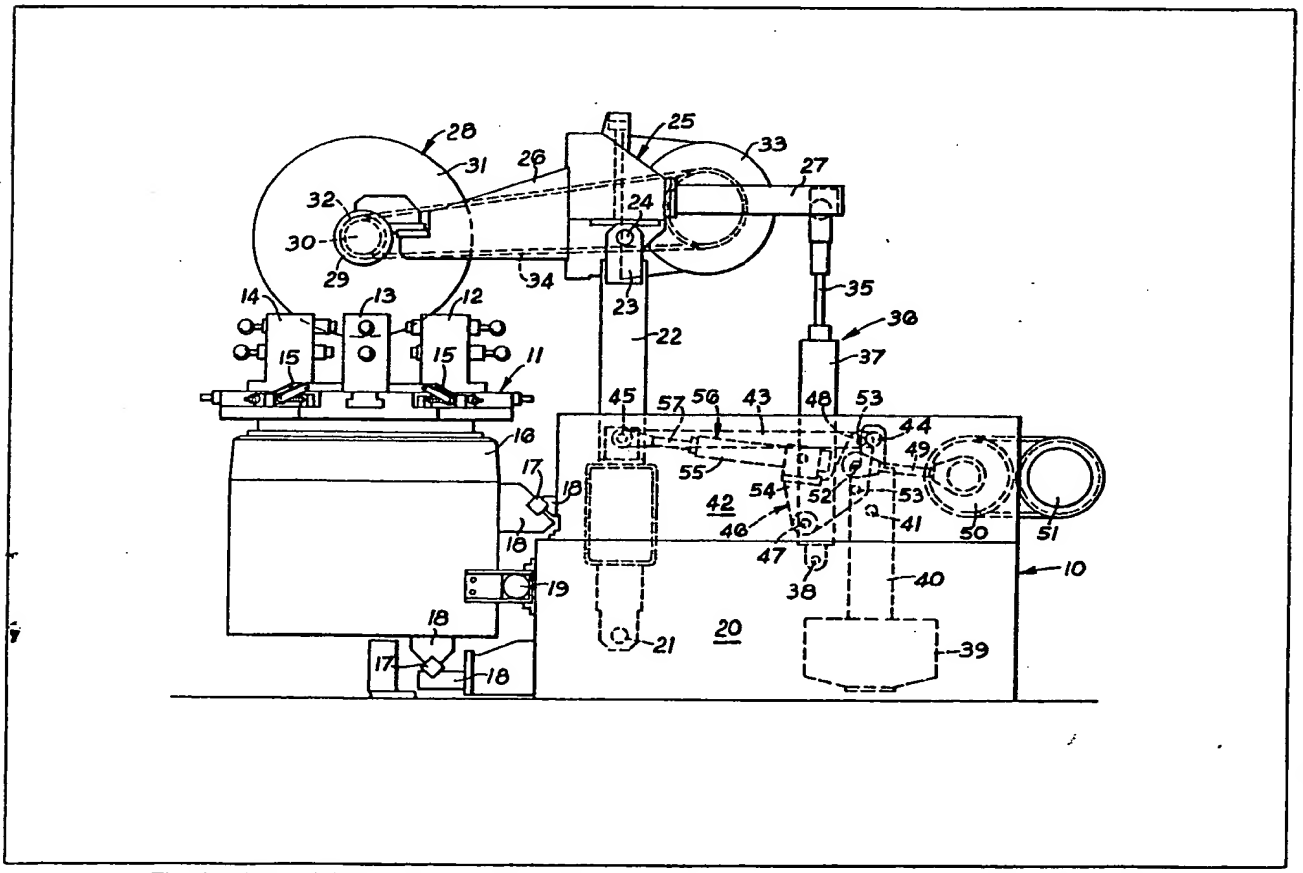
(54) Machine for treating workpieces

(57) Machining head 28, including cut-off disc 31 driven by motor 33, is mounted on arm 26 of beam 25 which is pivoted at 24 to permit the disc 31 to be brought down, by pressure ram 36, onto a workpiece (not shown) clamped to table 11. Pivot 24 mounts the beam 25 on upper end pillar 22 swingable about pivot 21 and coupled by connecting rod 43 with the upper end of balance weight arm 40 which is pivoted at 41 so that pivot 44 swings in an arc of much smaller radius than the pivot 45. This provides for the returning effect of weight 39 to increase with increase of deflection of the pillar 22 from the vertical. Eccentric 50 coupled through bell crank lever 46 and ram 56 to the pillar 22 enables the machining head 28 to be oscillated.



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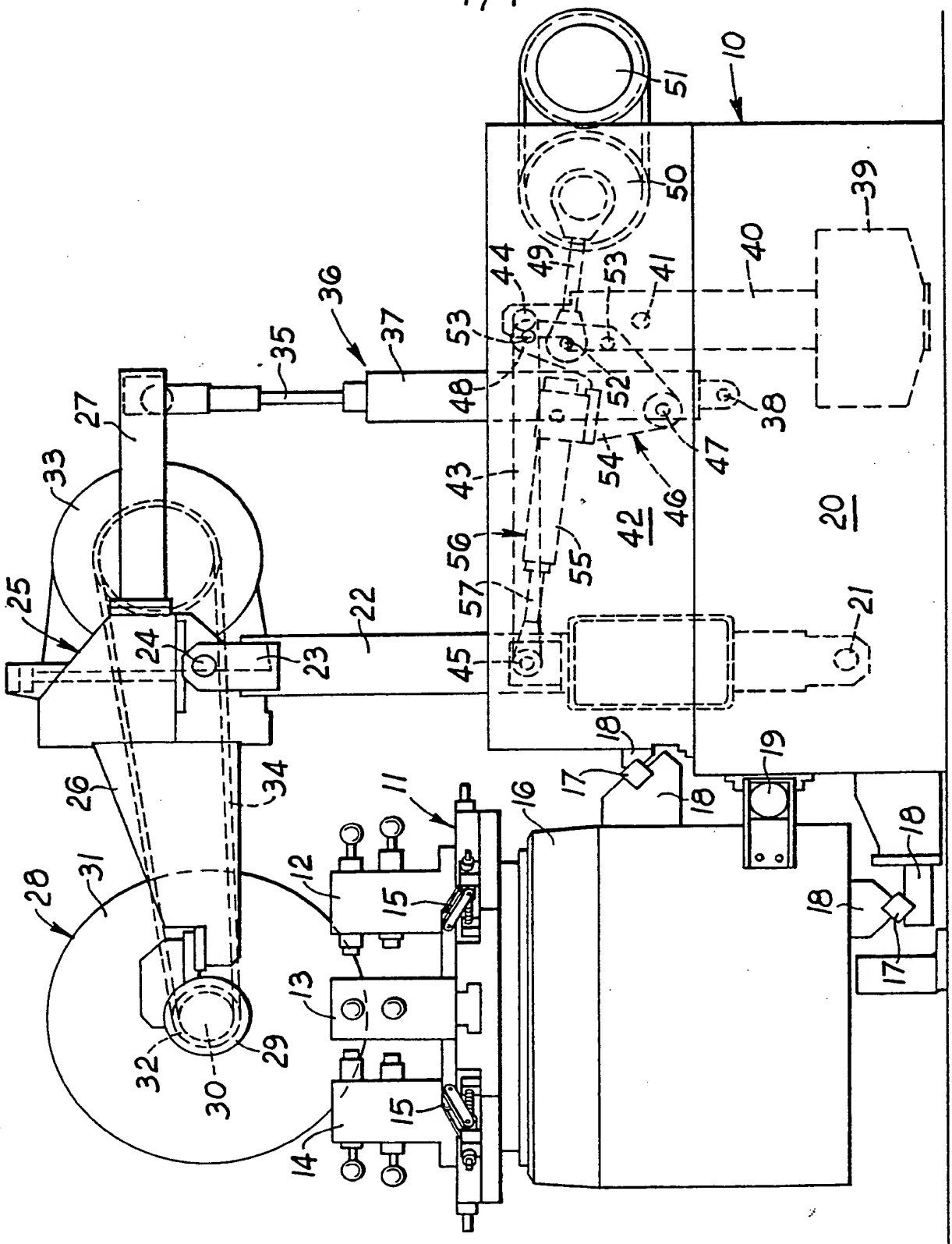
The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.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SPECIFICATION

Machine for treating workpieces

This invention relates to a machine for treating workpieces, such as metal castings, of the kind comprising a machining head carrying a blade, cut-off disc, grinding wheel, or other device for treating a workpiece, and mounted so as to be lowerable to engage a workpiece, for treating the latter.

It is already known to mount such a workpiece treating machine, for example in the form of a cutting machine, by suspending it from above so that it can be swung manually, about an overhead pivot, in a vertical plane substantially parallel to the plane of a blade or cut-off disc of the machine. In such an arrangement, however, the operator, in swinging the machine, has to work against its weight which tends to assume its lowermost disposition directly below the overhead pivot.

An object of the present invention is to provide a workpiece treating machine of the kind above referred to which can be traversed in a vertical plane substantially parallel to the plane of a blade, cut-off disc or other workpiece-treating device carried by the machining head, with a minimum of resistance from its own weight, the arrangement lending itself conveniently to the traversing movement being effected mechanically and, if desired, to the machining head being oscillated in the same plane as above mentioned to facilitate workpiece-treatment operations.

With this object in view, the present invention provides a workpiece treating machine of the kind comprising a machining head carrying a blade, cut-off disc, or other device for treating a workpiece, and mounted so as to be lowerable to engage a workpiece, such as a metal casting, for treating the latter, characterised in that the machining head is carried at one end of a beam swingably mounted, at or near its middle, at the upper end of a pillar which is swingable, about a substantially horizontal axis at or near its bottom end, in a plane parallel to the plane of the said device for treating a workpiece, the pillar being coupled with a balance weight effective to act against the weight of the beam and pillar, thereby to facilitate traversing movement of the machining head.

The balance weight is preferably provided at the bottom end of a pivotally-mounted balance weight arm.

Then, the coupling between the pillar and the balance weight arm is advantageously provided by a connecting rod or link pivotally connected between a pivot point about half way up the pillar and a pivot point at or near the top end of the balance weight arm, the pivotal axis of the latter being at a location about two thirds of the height between the centre of gravity of the weight and the pivot point at or near the top end of the balance weight arm. This arrangement provides for the effect of the balance weight to be amplified with increase in swinging movement of the pillar out of the vertical. With appropriate dimensioning of the distances between the pivots of the pillar and of the balance weight arm, to provide for the end of the connecting rod, connected to the balance weight arm, to move in an arc whose radius is considerably smaller than the arc of movement of the other end of the connecting rod, the arrangement may be such that the connection to the balance weight serves to restrict the possible swinging of the pillar.

Provision may be provided, in the arrangement of the invention, for the beam to be swung mechanically about its pivotal connection to the top end of the pillar. This can readily be achieved by means of a substantially upright machining pressure ram connected by its upper end to the end of the beam remote from the machining head and by its lower end to a fixed location on the machine. With such an arrangement, extension of the machining pressure ram causes downward movement of the machining head for effecting a workpiece treatment operation.

Provision may also be made for the pillar to be swung mechanically for traversing the machining head; furthermore, provision may be made for oscillating the machining head during workpiece treatment to contribute to the treatment effect of the treatment device. This may be achieved by means of a linkage between the pillar and an eccentric, which linkage includes a traverse ram which can be extended and contracted cyclically during workpiece treatment.

In a practical arrangement, the linkage comprises a bell crank lever one arm of which is connected to the traverse ram which in turn is pivotally connected to the pillar, and the other arm of which is coupled to the eccentric.

In order that the invention may be fully understood, it will be described further, by way of example, with reference to the accompanying drawing, in which the single figure is a side elevation of a preferred embodiment in the form of a cutting machine for cutting workpieces in the form of castings, e.g. to remove excess metal or sprue therefrom, the following description being illustrative, and not restrictive, of the scope of the invention.

The illustrated machine comprises a basic supporting framework 10 adjacent one end of which is a workpiece-supporting table 11 having clamping jaws 12, 13 and 14 and, optionally, supporting jacks 15 whereby a workpiece (not shown) for instance in the form of a metal casting from which waste or excess material is required to be removed, can be supported and clamped in an appropriate position ready for cutting. The table 11 is carried upon a table carriage 16 mounted by

guide rails 17 and slideways 18 for linear substantially horizontal movement transversely of the framework 10. A table-traversing ram 19 enables the carriage 16 to be displaced mechanically. The framework 10 comprises robust lower mounting plates 20 (of which one only is visible in the figure) which are disposed side-by-side in respective vertical planes.

Located in the mounting plates 20 are the ends of a main pivot 21 which extends through a bearing (not visible) located at the bottom end of a substantially upright pillar 22 disposed between said plates 20 at the end of the frame 10 nearest to the workpiece supporting table 11. This pillar 22 projects upwardly past the tops of the mounting plates 20 and at its upper end it has secured thereto a pair of side cheeks 23 (of which one only is visible) apertured for a top pivot pin 24 to extend therebetween. This top pivot pin 24 serves to mount, on the top of the pillar 22, a beam, indicated generally by reference numeral 25, one arm 26 of which extends forwardly over the table 11, and the other arm 27 of which extends rearwardly of the machine. At its free end, the said one arm 26 carries a machining head, indicated generally by the reference numeral 28, comprising a bearing 29 in which is journalled a spindle 30 on one end of which is mounted a workpiece treatment device in the form of a circular saw blade or cutter disc 31 and on the other end of which is a drive pulley 32 adapted to be driven from a cutter drive motor 33 mounted on the other arm 27 of the beam 25 relatively close to the top end of the pillar 22, by way of an endless belt 34.

The free end of the said other arm 27 of the beam 25 connects to the top end of a piston rod 35 of a substantially vertical machining pressure ram 36 the lower end of cylinder 37 of which is relatively fixed by reason of it having therethrough a respective pivot pin 38 whose ends are located in the mounting plates 20.

The pillar 22 is coupled to a balance weight 39. This balance weight 39 is provided on the bottom end of a balance weight arm 40 which is carried on a respective pivot pin 41 located by its ends in upper mounting plates 42 at a position near to the rear end of the frame 10. This pivot pin 41 of the balance weight arm 40 is located about two-thirds of the way up the height of the said arm 40, and a fixed-length approximately-horizontal connecting rod 43 pivotally connects between a pivot 44 at the top end of the balance weight arm 40 and a pivot 45 disposed about half way up the height of the pillar 22.

Mounted between the upper plates 42 is a combined traversing and oscillating arrangement. This comprises a bell-crank lever unit 46 mounted between the plates 42 on a pivot 47 having one arm 48 connected to a linkage 49 to an eccentric 50 adopted to be driven by an adjacent variable-speed drive motor 51, which serves to provide oscillating movement to the bell crank lever 46 by way of the eccentric 50, and may be regarded as an oscillator motor. Selection of the throw of the bell crank lever 46 may be achieved by selectively connecting the linkage 49 by coupling pin 52 being engaged into a selected one of three alternative coupling apertures 53 in the bell crank lever 46. The other arm 54 of the bell-crank lever 46 connects to rear end of cylinder 55 of a traverse ram 56 whose piston 57 connects with the pillar 22 by the pivot 45 which as previously mentioned is at about half way up the height of the pillar 22.

The manner of operation of the machine will readily be understood from the foregoing. For treating a workpiece by cutting, the workpiece is appropriately positioned, with suitable adjustment, on the table 11, the cutter drive motor 33 is switched on and the cylinder 37 of the machining pressure ram 36 is supplied with fluid under pressure, thereby to extend its piston 35 and cause swinging movement of the beam 25 which causes the saw blade or cut-off disc 31 to be brought down upon the workpiece for cutting the latter.

Upon the oscillator motor 51 being switched on, the latter, through the eccentric 50 and bell-crank lever arrangement 46, imposes an oscillating movement, with amplitude corresponding to the eccentricity of the eccentric 50, upon the pillar 22, and consequently upon the machining head 28 and the blade or cut-off disc 31 carried thereby. Moreover, the traverse ram 56 can be extended and contracted cyclically during the cutting operation and this correspondingly causes swinging movement of the pillar 22 to traverse the blade or cut-off disc 31 back and forth across the workpiece.

The position of the blade or cut-off disc's cutting edge relative to the workpiece is important. Where the workpiece is, for example, a square section bar, if the first contact point of the cutting edge of the blade or cut-off disc 31 with the bar is the centre of the bar the drive motor 33 will use a particular amount of current and therefore a particular blade or cut-off disc life will be obtained. By moving the aforesaid first contact point to that edge of the bar which is remote from the pivot pin 24, the current of the drive motor 33 will be reduced by a large percentage and correspondingly the life of blade or cut-off disc 31 will be reduced. By moving the first contact point to that edge of the bar nearest to the pivot pin 24 the reverse effect occurs, that is the current to the drive motor 33 increases and so therefore does the life of the blade or cut-off disc 31.

The balance weight 39 serves, of course, to balance the weight of the beam 25. The arrangement as described, has the pivotal

connection 44 between the connecting rod 43 and the top end of the balance weight arm 40 at a spacing, above the pivot 41 of the balance weight arm 40, which is about one third of the spacing of the pivotal connection 45 of the other end of the connecting rod 43 above the main pivot 21 of the pillar 22. This arrangement provides for amplification of the effect of the balance weight 39 with increase in swinging of the pillar 22 out of vertical, so that the balance weight 39 always tends to keep the beam 25, and therefore the machining head 28, relatively stationary. Accordingly the power needed to effect traversing movement is relatively low. In an arrangement having no traverse ram 56, the beam 25 will be movable relatively easily by hand.

Of course the invention is not confined to the precise details of the foregoing example and variations may be made thereto, if desired. Thus, for instance, the shape of and manner of mounting of the pillar 22 and/or the balance weight 39 and its arm 40 can vary from what has been described, as also can be the means provided for applying machining pressure, traverse movement and oscillating movement. If the machine is required to perform workpiece-treatment operations other than cutting, an appropriate workpiece-treatment device, such as a grinding wheel, milling cutter or the like may be provided in the place of the saw blade or cut-off disc 31.

CLAIMS

1. A workpiece treating machine of the kind comprising a machining head carrying a blade, cut-off disc, or other device for treating a workpiece, and mounted so as to be lowerable to engage a workpiece, such as a metal casting, for treating the latter, characterised in that the machining head is carried at one end of a beam swingably mounted, at or near its middle, at the upper end of a pillar which is swingable, about a substantially horizontal axis at or near its bottom end, in a plane parallel to the plane of the said device for treating a workpiece, the pillar being coupled with a balance weight effective to act against the weight of the beam and pillar, thereby to facilitate traversing movement of the machining head.

2. A machine as claimed in claim 1 wherein the balance weight is provided at the bottom end of a pivotally-mounted balance weight arm.

3. A machine as claimed in claim 2 wherein a coupling between the pillar and the balance weight arm provides for the effect of the balance weight to be amplified with increase in swinging movement of the pillar out of the vertical.

4. A machine as claimed in claim 3 in which the coupling between the pillar and the balance weight arm is provided by a connecting rod or link pivotally connected between a pivot point about half way up the pillar and a pivot point at or near the top end of the balance weight arm, the pivotal axis of the latter being at a location about two thirds of the height between the centre of gravity of the weight and the pivot point at or near the top end of the balance weight arm.

5. A machine as claimed in claim 3 or 4 wherein the coupling between the pillar and the balance weight arm serves to restrict the possible swinging of the pillar.

6. A machine as claimed in claim 5 wherein the distances between the pivots of the pillar and of the balance weight arm are selected to provide for the end of the connecting rod, connected to the balance weight arm, to move in an arc whose radius is considerably smaller than the arc of movement of the other end of the connecting rod.

7. A machine as claimed in any preceding claim having means providing for the beam to be swung mechanically about its pivotal connection to the top end of the pillar.

8. A machine as claimed in claim 7 wherein the means providing for the beam to be swung comprises a substantially upright machining pressure ram connected by its upper end to the end of the beam remote from the machining head and by its lower end to a fixed location on the machine.

9. A machine as claimed in any preceding claim having means providing for the pillar to be swung mechanically for traversing the machining head.

10. A machine as claimed in any preceding claim having means providing for oscillating the machining head during workpiece treatment to contribute to the treatment effect of the treatment device.

11. A machine as claimed in claim 10 wherein the means providing for oscillating the machining head comprises a linkage between the pillar and an eccentric, which linkage includes a traverse ram which can be extended and contracted cyclically during workpiece treatment.

12. A machine as claimed in claim 11 in which the linkage comprises a bell crank lever one arm of which is connected to the traverse ram which in turn is pivotally connected to the pillar, and the other arm of which is coupled to the eccentric.

13. A workpiece treating machine substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1981.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.